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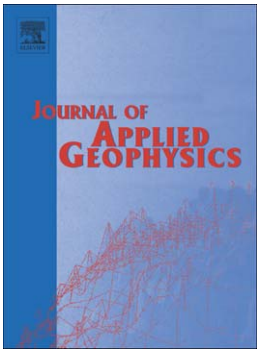

A comparison between single- and multi-objective optimization to fit spectral induced polarization data from laboratory measurements on alluvial sediments

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ACCEPTED MANUSCRIPT

Title: A comparison between single- and multi-objective optimization to fit spectral induced polarization data from laboratory measurements on alluvial sediments

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Keywords:

spectral induced polarization; multi-objective optimization; Cole-Cole model; Pareto frontier; root mean square error

Abstract: Spectral induced polarization measurements on unconsolidated and saturated alluvial samples, sand-clay mixtures and well sorted sandy samples, are modelled with the generalized Cole-Cole phenomenological model and two simplified models: the standard Cole-Cole and the Cole-Davidson model. The goodness of fit is evaluated, as a first step, through the root mean square error, weighted on the data errors of the real and the imaginary component. At a later stage a multi-objective optimization is proposed, based on two different indicators for the resistivity amplitude and phase misfit. The analysis of the misfits variations among all the tested parameters associations is conducted to identify the Pareto set of optimal solutions. Both procedures lead to model parameter estimates comparable with literature values. However, the multi-objective approach provides information about the uncertainty of the parameter estimates and highlights the presence of more than one characteristic value for the relaxation time and the frequency

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